



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
2002/01335

January 6, 2003

Mr. Lawrence Evans
U.S. Army Corps of Engineers, Portland District
ATTN: John Barco
P.O. Box 2946
Portland, OR 97208-2946

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Act
Essential Fish Habitat Consultation on Maintenance Dredging by Portland Yacht Club,
Willow Bar Slough, Columbia River, Columbia County, Oregon (Corps. No.1997-
00548).

Dear Mr. Evans:

Enclosed is a biological opinion (Opinion) prepared by the National Marine Fisheries Service (NOAA Fisheries) pursuant to section 7 of the Endangered Species Act (ESA) on the effects of proposed maintenance dredging in Willow Bar Slough, Columbia River, Columbia County, Oregon. NOAA Fisheries concludes in this Opinion that the proposed action is not likely to jeopardize the continued existence of ESA-listed Snake River (SR) sockeye salmon (*Oncorhynchus nerka*), SR fall-run chinook salmon (*O. tshawytscha*), SR spring/summer-run chinook salmon, Upper Columbia River (UCR) spring chinook salmon, Lower Columbia River chinook (LCR) salmon, Upper Willamette River (UWR) chinook salmon, Columbia River chum salmon (*O. keta*), SR steelhead (*O. mykiss*), UCR steelhead, Middle Columbia River steelhead, UWR steelhead, and LCR steelhead, or destroy or adversely modify critical habitat. As required by section 7 of the ESA, we include reasonable and prudent measures with non-discretionary terms and conditions that are necessary to minimize the potential for incidental take associated with this action.

This Opinion also serves as consultation on essential fish habitat (EFH) for chinook salmon (*O. tshawytscha*) and coho salmon (*O. kisutch*) and starry flounder (*Platyichthys stellatus*) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation Management Act (MSA) and its implementing regulations at 50 CFR Part 600.



Please direct any questions regarding this consultation to Christy Fellas of my staff in the Oregon Habitat Branch at 503.231.2307.

Sincerely,

for Michael R Crouse

D. Robert Lohn
Regional Administrator

cc: Phil Gentemann, Portland Yacht Club
Tom Melville, Oregon DEQ

Endangered Species Act - Section 7 Consultation
&
Magnuson-Stevens Act
Essential Fish Habitat Consultation

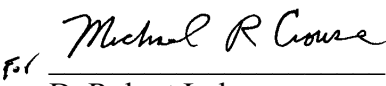
BIOLOGICAL OPINION

Maintenance Dredging by Portland Yacht Club,
Willow Bar Slough, Columbia River,
Columbia County, Oregon (Corps. No.1997-00548)

Agency: U.S. Army Corps of Engineers

Consultation
Conducted By: NOAA Fisheries,
Northwest Region

Date Issued: January 6, 2003

Issued by: 
D. Robert Lohn
Regional Administrator

Refer to: 2002/01335

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1. ENDANGERED SPECIES ACT

1.1 Background

On November 19, 2002, the National Marine Fisheries Service (NOAA Fisheries) received a letter from the U.S. Army Corps of Engineers (COE) requesting formal consultation pursuant to the Endangered Species Act (ESA) for the issuance of a permit under section 10 of the Rivers and Harbors Act and section 404 of the Clean Water Act to Portland Yacht Club (PYC) to allow maintenance dredging of Willow Bar Slough on the Columbia River, Columbia County, Oregon. The COE determined the proposed action was likely to adversely affect the following ESA listed species: Snake River (SR) steelhead (*Oncorhynchus mykiss*), Upper Columbia River (UCR) steelhead, Middle Columbia River (MCR) steelhead, Upper Willamette River (UWR) steelhead, Lower Columbia River (LCR) steelhead, SR spring/summer chinook salmon (*O. tshawytscha*), SR fall chinook salmon, UCR spring-run chinook salmon, UWR chinook salmon, LCR chinook salmon, Columbia River chum salmon (*O. keta*), and SR sockeye salmon (*O. nerka*).

This biological opinion (Opinion) considers the potential effects of the proposed action on SR steelhead, UCR steelhead, MCR steelhead, UWR steelhead, LCR steelhead, SR spring/summer chinook salmon, SR fall chinook salmon, UCR spring-run chinook salmon, UWR chinook salmon, LCR chinook salmon, Columbia River chum salmon, and SR sockeye salmon. The subject action will occur within designated critical habitat for these species. Species' information references, listing dates, critical habitat designations, and take prohibitions are listed in Table 1. The objective of this Opinion is to determine whether the proposed action is likely to jeopardize the continued existence of the ESA listed species, or destroy or adversely modify designated critical habitat for this species. This consultation is conducted pursuant to section 7(a)(2) of the ESA and its implementing regulations, 50 CFR 402.

1.2 Proposed Action

The proposed project is maintenance dredging at the PYC facility in Willow Bar Slough off the Columbia River. The current permit, which expires in February 2004, was issued by the COE to allow maintenance dredging and upland disposal. This proposal requests to use flow lane disposal instead of upland disposal. The permit would allow up to 15,000 cubic yards of sediment to be dredged and deposited to the in-water disposal area east of Willow Bar Slough in the Columbia River, prior to February 2004.

A hydraulic dredge will be used to remove sediment in Willow Bar Slough and it will be piped to an in-water disposal area. The spoils would be spread evenly to leave a smooth bottom at the disposal site. Work is scheduled to be completed during the in-water work window of November 1 to February 28. The following best management practices (BMPs) are proposed as part of the project:

1. Dredged materials will only be disposed of in the approved location, and in a manner that prevents in-water mounding. No dredge spoils will be placed in spawning areas or areas with submerged aquatic vegetation.
2. Sediment quality will be evaluated before dredging begins using the most recent version of NOAA Fisheries-approved criteria for evaluation of contaminated sediments.
3. Dredge discharge pipe will be maintained at depths greater than 20 feet below surface during flow lane disposal

1.3 Biological Information and Critical Habitat

The action area is defined by NOAA Fisheries regulations (50 CFR 402) as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.” The action area is Willow Bar Slough from the mouth to the PYC facility and the Columbia river flow lane disposal site. Designated critical habitat for the listed SR ESUs considered in this Opinion occurs within the proposed action area. Essential habitat features for salmonids are: Substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food (juvenile only), riparian vegetation, space, and safe passage conditions (50 CFR 226). The proposed action may affect the essential habitat features of water quality, substrate and food. References for further background on listing status and biological information can be found in Table 1.

1.4 Evaluating the Proposed Actions

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined by 50 CFR 402 (the consultation regulations). NOAA Fisheries must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify critical habitat. This analysis involves the initial steps of defining the biological requirements of the listed species, and evaluating the relevance of the environmental baseline to the species' current status.

Subsequently, NOAA Fisheries evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries must consider the estimated level of mortality attributable to: (1) Collective effects of the proposed or continuing action; (2) the environmental baseline; and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed species' life stages that occur beyond the action area. If NOAA Fisheries finds that the action is likely to jeopardize, NOAA Fisheries must identify reasonable and prudent alternatives for the action.

NOAA Fisheries also evaluates whether the action, directly or indirectly, is likely to destroy or adversely modify the listed species' critical habitat. NOAA Fisheries must determine whether habitat modifications appreciably diminish the value of critical habitat for both survival and

recovery of the listed species. NOAA Fisheries identifies those effects of the action that impair the function of any essential element of critical habitat. NOAA Fisheries then considers whether such impairment appreciably diminishes the habitat's value for the species' survival and recovery. If NOAA Fisheries concludes that the action will adversely modify critical habitat, it must identify any reasonable and prudent alternatives available.

For the proposed action, NOAA Fisheries' jeopardy analysis considers direct or indirect mortality of fish attributable to the action. NOAA Fisheries' critical habitat analysis considers the extent to which the proposed action impairs the function of essential elements necessary for migration, spawning, and rearing of the listed species under the existing environmental baseline.

1.4.1 Biological Requirements

The first step in the methods NOAA Fisheries uses for applying the ESA section 7(a)(2) to listed salmon is to define the species' biological requirements that are most relevant to each consultation. NOAA Fisheries also considers the current status of the listed species, taking into account population size, trends, distribution, and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list the species for ESA protection, and also considers new data available that is relevant to the determination.

The relevant biological requirements are those necessary for salmonids to survive and recover to naturally-reproducing population levels, at which time protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance its capacity to adapt to various environmental conditions, and allow it to become self-sustaining in the natural environment.

For this consultation, the biological requirements are improved habitat characteristics that function to support successful migration, rearing habitat and over-wintering refugia. Salmon survival in the wild depends upon the proper functioning of certain ecosystem processes, including habitat formation and maintenance. Restoring functional habitats depends largely on allowing natural processes to increase their ecological function, while at the same time removing adverse impacts of current practices. In conducting analyses of habitat-altering actions, NOAA Fisheries usually defines the biological requirements in terms of a concept called Properly Functioning Condition (PFC) and utilizes a "habitat approach" to its analysis.¹ The current status of listed salmonids in the Columbia River, based upon their risk of extinction, has not

¹ National Marine Fisheries Service, Northwest Region. 26 August 1999. The Habitat Approach: Implementation of Section 7 of the Endangered Species Act for Actions Affecting the Habitat of Pacific Anadromous Salmonids. Guidance memorandum from Assistant Regional Administrators for Habitat Conservation and Protected Resources to staff. 13 pages. NOAA Fisheries, 525 NE Oregon St, Ste 500, Portland, OR 97232-2737.

significantly improved since the species were listed. NOAA Fisheries is not aware of any new data that would indicate otherwise.

1.4.2 Environmental Baseline

The most recent evaluation of the environmental baseline for the Columbia River is part of NOAA Fisheries's Opinion for the Federal Columbia River Power System (FCRPS), issued in December 2000. This Opinion assessed the entire Columbia River system below Chief Joseph Dam, and downstream to the farthest point (the Columbia River estuary and nearshore ocean environment) at which listed salmonids are influenced. A detailed evaluation of the environmental baseline of the Columbia River basin can be found in the FCRPS Opinion (NMFS 2000).

The quality and quantity of freshwater habitats in much of the Columbia River basin have declined dramatically in the last 150 years. Forestry, farming, grazing, road construction, hydrosystem development, mining, and urbanization have radically changed the historical habitat conditions of the basin. Depending on the species, they spend from a few days to one or two years in the Columbia River and its estuary before migrating out to the ocean and another one to four years in the ocean before returning as adults to spawn in their natal streams.

Water quality in streams throughout the Columbia River basin has been degraded by human activities such as dams and diversion structures, water withdrawals, farming and grazing, road construction, timber harvest activities, mining activities, and urbanization. Tributary water quality problems contribute to poor water quality where sediment and contaminants from the tributaries settle in mainstem reaches and the estuary. Temperature alterations also affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Loss of wetlands and increases in groundwater withdrawals have contributed to lower base-stream flows, which in turn contribute to temperature increases. Channel widening and land uses that create shallower streams also cause temperature increases.

Pollutants also degrade water quality. Salmon require clean gravel for successful spawning, egg incubation, and emergence of fry. Fine sediments clog the spaces between gravel and restrict the flow of oxygen-rich water to the incubating eggs. Excess nutrients, low levels of dissolved oxygen, heavy metals, and changes in pH also directly affect the water quality for salmon and steelhead.

Water quantity problems are also a significant cause of habitat degradation and reduced fish production. Withdrawing water for irrigation, urban, and other uses can increase temperatures, smolt travel time, and sedimentation. Return water from irrigated fields can introduce nutrients and pesticides into streams and rivers. On a larger landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Many riparian areas, flood plains, and wetlands that once stored water during periods of high runoff have been

developed. Urbanization paves over or compacts soil and increases the amount and pattern of runoff reaching rivers and streams.

Based on the best available information regarding the current status of the listed species range-wide, the population status, trends, genetics, and the poor environmental baseline conditions within the action area, NOAA Fisheries concludes that the biological requirements of these species are not currently being met. Degraded habitat resulting from agricultural practices, forestry practices, road building, and residential construction indicate many aquatic habitat indicators are not properly functioning within the Columbia River basin. Actions that do not maintain or restore properly functioning aquatic habitat conditions would be likely to jeopardize the continued existence of these species.

1.5 Analysis of Effects

1.5.1 Effects of the Proposed Action

Dredging

Dredging and disposal of dredged material speed up the natural processes of sediment erosion, transportation and deposition (Morton 1977). The physical effects to the river system from dredging and disposal briefly summarized are: (1) Temporary increases in turbidity; (2) changes in bottom topography with resultant changes in water circulation; and (3) changes in the mechanical properties of the sediment at the dredge and disposal sites (Nightingale and Simenstad 2001, Hershman 1999, Morton 1977). The significance of the effect is a function of the ratio of the size of the dredged area to the size of the bottom area and water volume (Morton 1977).

Potential effects to listed salmonids from the proposed action include both direct and indirect effects. Potential direct effects include entrainment of juvenile fish (Nightingale and Simenstad 2001, Armstrong *et al.* 1982, Tutty 1976, Dutta and Sookachoff 1975a, Boyd 1975) and mortality from exposure to suspended sediments (turbidity) (Nightingale and Simenstad 2001). Entrainment of juvenile fish will be minimized in the proposed project by keeping the hydraulic dredge intake at or just below the surface of the material being removed, and only raising the intake for brief periods of purging or flushing. Potential indirect effects include behavioral and sub-lethal affects from exposure to increased turbidity (Nightingale and Simenstad 2001, Emmett *et al.* 1988, Gregory 1988, Servizi 1988, Sigler 1988, Kirn *et al.* 1986, Berg and Northcote 1985, Sigler *et al.* 1984, Whitman *et al.* 1982); mortality from predatory species associated with dredged material disposal (Nightingale and Simenstad 2001).

Suspended sediment and turbidity influences on fish reported in the literature range from beneficial to detrimental. Elevated total suspended solids (TSS) conditions have been reported to enhance cover conditions, reduce piscivorous fish/bird predation rates, and improve survival. Elevated TSS conditions have also been reported to cause physiological stress, reduce growth, and reduce survival. Of key importance in considering the detrimental effects of TSS on fish are the frequency and the duration of the exposure (not just the TSS concentration).

Behavioral avoidance of turbid waters may be one of the most important effects of elevated suspended sediments (DeVore *et al.* 1980, Birtwell *et al.* 1984, Scannell 1988). Salmonids have been observed to move laterally and downstream to avoid turbid plumes (McLeay *et al.* 1984, 1987, Sigler *et al.* 1984, Lloyd 1987, Scannell 1988, Servizi and Martens 1991). Juvenile salmonids tend to avoid streams that are chronically turbid, such as glacial streams or those disturbed by human activities, except when the fish must traverse these streams along migration routes (Lloyd *et al.* 1987). In addition, a potential positive effect is providing refuge and cover from predation (Gregory and Levings 1998).

Fish that remain in turbid, or elevated TSS, waters experience a reduction in predation from piscivorous fish and birds (Gregory and Levings 1998). In habitats with intense predation pressure, this provides a beneficial trade-off (*e.g.*, enhanced survival) to the cost of potential physical effects (*e.g.*, reduced growth). Turbidity levels of about 23 Nephelometric Turbidity Units (NTU) have been found to minimize bird and fish predation risks (Gregory 1993). Exposure duration is a critical determinant of the occurrence and magnitude of physical or behavioral effects (Newcombe and MacDonald 1991). Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with floods, and are adapted to such high pulse exposures. Adult and larger juvenile salmonids appear to be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjornn and Reiser 1991). However, chronic exposure can cause physiological stress that can increase maintenance energy and reduce feeding and growth (Redding *et al.* 1987, Lloyd 1987, Servizi and Martens 1991).

Turbidity, at moderate levels, has the potential to reduce primary and secondary productivity, and at high levels, has the potential to injure and kill adult and juvenile fish, and may also interfere with feeding (Spence *et al.* 1996, Bjornn and Reiser 1991). Other behavioral effects on fish, such as gill flaring and feeding changes, have been observed in response to pulses of suspended sediment (Berg and Northcote 1985). Fine redeposited sediments also have the potential to reduce primary and secondary productivity (Spence *et al.* 1996), and to reduce incubation success (Bell 1991) and cover for juvenile salmonids (Bjornn and Reiser 1991).

Issues involving turbidity associated with flow lane disposal were addressed in previous biological opinions with the COE for navigation channel maintenance dredging (NMFS 1993, NMFS 1999). NOAA Fisheries did not believe that mortality resulting from turbidity was an issue of concern during those consultations and has no information that would change that belief for this Opinion. The sediment test results suggest that the material to be dredged from Willow Bar Slough does not exceed current DMEF contaminant screening levels and is suitable for in-water disposal. Regardless of the determination, NOAA Fisheries has ongoing concerns about the potential effects of sediment contaminants, particularly sublethal and cumulative effects. Direct and indirect adverse effects may be exhibited at very low concentrations for some contaminants (Brewer *et al.* 2001, Moore and Waring 2001, Beauvais *et al.* 2000, Johnson 2000, Scholz *et al.* 2000, NMFS 1998, Waring and Moore 1997, Zuranko *et al.* 1997, Moore and Waring 1996, Meador 1991). Sediments will be tested prior to each dredging event and results submitted to NOAA Fisheries for review of possible contaminants that may affect listed species.

Dredged material disposed of in the flow lane will not collect at the point of discharge, but will be transported in the lower water column and be distributed over a large area. Eventually, the majority of dredged material is expected to be transported out to sea by river currents and natural bedload transport. Therefore, the effects of flow lane disposal may extend well downstream. Any adverse effects presumably will diminish the further downstream the material is transported and dispersed. The deposition of some dredged material is likely in low current areas of the river and may remain in the riverine system for extended periods.

While further study is warranted on shallow water habitat dredging, current information suggests the size of the proposed action will limit any turbidity effects to a low level of incidence at the dredge site. The proposed timing (November 1 to February 28) should minimize turbidity exposure to at-risk juvenile salmonids. NOAA Fisheries expects adult salmonids (*e.g.*, steelhead, chum salmon, and coho salmon) to avoid the turbidity plume. NOAA Fisheries anticipates short-term turbidity from the proposed dredging project.

Construction Equipment.

As with all construction activities, accidental release of fuel, oil, and other contaminants may occur. Operation of the dredge equipment requires the use of fuel, lubricants, *etc.*, which if spilled into a water body or the adjacent riparian zone, could injure or kill aquatic organisms. Petroleum-based contaminants (such as fuel, oil, and some hydraulic fluids) contain PAHs which can cause acute toxicity to salmonids at high levels of exposure, and can also cause chronic lethal as well as acute and chronic sublethal effects to aquatic organisms (Neff 1985).

Equipment used in the proposed project will be refueled only in designated areas away from waterways. Fuel, oil and other contaminants will be prevented from entering the water by frequently checking equipment for leaks and making appropriate repairs to equipment.

1.5.2 Effects on Critical Habitat

NOAA Fisheries designates critical habitat based on physical and biological features that are essential to the listed species. Essential features of designated critical habitat include substrate, water quality, water quantity, water temperature, food, riparian vegetation, access, water velocity, space and safe passage. The proposed project may affect substrate and water quality (turbidity).

NOAA Fisheries anticipates short-term effects on critical habitat from the proposed dredging project. The action area includes designated critical habitat for Snake River listed species utilized as a migratory corridor and rearing habitat. Neither the Columbia River mainstem or Willow Bar Slough provide spawning habitat for these listed species. The dredge spoils will be deposited in the mainstem Columbia River at mile 94.4 at a 30 to 40 foot depth. NOAA Fisheries does not expect sediment distributed at this depth to affect fish passage or substrate necessary to provide properly functioning critical habitat to support listed species. NOAA

Fisheries anticipates short-term effects on water quality from turbidity associated with dredging activities and does not expected measurable long-term harm to critical habitat features.

1.5.3 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as those effects of "future State or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation." Future federal actions, including the ongoing operation of hydropower systems, hatcheries, fisheries, and land management activities are being (or have been) reviewed through separate section 7 consultation processes. Therefore, these actions are not considered cumulative to the proposed action.

NOAA Fisheries is not aware of any specific future non-federal activities within the action area that would cause greater impacts to listed species than presently occurs. NOAA Fisheries assumes that future private and state actions will continue at similar intensities as in recent years.

1.6 Conclusion

NOAA Fisheries has determined that, based on the available information, the proposed action is not likely to jeopardize the continued existence of listed species, or destroy or adversely modify designated critical habitat. NOAA Fisheries used the best available scientific and commercial data to analyze the effects of the proposed action on the biological requirements of the species relative to the environmental baseline, together with cumulative effects. This finding is based on incorporation of best management practices (BMPs) into the proposed project design and on the following considerations: (1) Testing indicates sediment contaminants are below known harmful thresholds, and dredging and in-water disposal will not pose an undue risk of exposure; (2) dredging will occur when listed species are present in relatively low numbers and the risk of entrainment is reduced; (3) sediments will be analyzed and results submitted to NOAA Fisheries prior to every dredging event; and (4) the period of dredged material disposal will occur when listed species are present in relatively low numbers and background turbidity levels are already elevated.

1.7 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on listed species, to minimize or avoid adverse modification of critical habitats, or to develop additional information. NOAA Fisheries believes the following conservation recommendations are consistent with these obligations, and therefore should be carried out by the COE for Columbia River dredging activities conducted under COE authorization:

1. The COE should reassess the potential effects of contaminants, including sublethal effects and bioaccumulation, on fish and benthic prey species from in-water disposal of dredged materials.
2. The COE should work to revise the DMEF to reflect the results of the effects reassessment in conservation recommendation #1, above.

In order for the NOAA Fisheries to be kept informed of actions minimizing or avoiding adverse effects, or those that benefit listed salmon and their habitats, NOAA Fisheries requests notification of any actions leading to the achievement of these conservation recommendations.

1.8 Reinitiation of Consultation

This concludes formal consultation on these actions in accordance with 50 CFR 402.14(b)(1). Reinitiation of consultation is required: (1) If the amount or extent of incidental take is exceeded; (2) the action is modified in a way that causes an effect on the listed species that was not previously considered in the biological assessment and this Opinion; (3) new information or project monitoring reveals effects of the action that may affect the listed species in a way not previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

2. INCIDENTAL TAKE STATEMENT

Section 9 and rules promulgated under section 4(d) of the ESA prohibit any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of listed species without a specific permit or exemption. "Harm" is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, and sheltering. "Harass" is defined as actions that create the likelihood of injuring listed species by annoying it to such an extent as to significantly alter normal behavior patterns which include, but are not limited to, breeding, feeding, and sheltering. "Incidental take" is take of listed animal species that results from, but is not the purpose of, the Federal agency or the applicant carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement

An incidental take statement specifies the impact of any incidental taking of threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

2.1 Amount or Extent of the Take

NOAA Fisheries anticipates that the action covered by this Opinion is reasonably certain to result in incidental take resulting from turbidity, entrainment and degradation of water quality. These effects are expected to be short-term. Even though NOAA Fisheries expects some low level of non-lethal (turbidity) and/or lethal (entrainment) incidental take to occur due to the action covered by this Opinion, the best scientific and commercial data available are not sufficient to enable NOAA Fisheries to estimate a specific amount of incidental take to the species itself. In instances such as these, NOAA Fisheries designates the expected amount of take as “unquantifiable”. Based on the information provided by the COE and other available information, NOAA Fisheries anticipates that an unquantifiable amount of incidental take could occur as a result of the action covered by this Opinion.

The extent of the take is limited to turbidity, entrainment and degradation of water quality resulting from maintenance dredging in Willow Bar Slough and deposit of dredge spoils in the flowlane of the Columbia River. The extent of the take includes the substrate and water column of the Columbia River, extending within the Willow Bar Slough area of dredging and within the mainstem Columbia River at the depository of the dredge spoils and downstream to the extent of visible short-term turbidity increases resulting from the project work. If the proposed project or project area changes, consultation will be reinitiated to evaluate the effect of changes in the project to listed species.

2.2 Reasonable and Prudent Measures

NOAA Fisheries believes that the following reasonable and prudent measures are necessary and appropriate to avoid or minimize take of listed salmonid species resulting from the action covered by this Opinion. The COE shall include measures that will:

1. Minimize incidental take from general construction by excluding unauthorized permit actions and applying permit conditions that avoid or minimize adverse effects to riparian and aquatic systems.
2. Minimize incidental take by from maintenance dredging excluding unauthorized permit actions and applying permit conditions that avoid or minimize adverse effects to riparian and aquatic systems.
3. Complete a comprehensive monitoring and reporting program to ensure implementation of these conservation measures are effective at minimizing the likelihood of take from permitted activities.

2.3 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the COE must comply with the following terms and conditions, which implement the reasonable and prudent measures

described above. These terms and conditions are non-discretionary and, in relevant part, apply equally to proposed actions in all categories of activity.

1. To implement reasonable and prudent measure #1 (general conditions for construction, operation and maintenance), the COE shall ensure that:
 - a. Timing of in-water work. Work within the active channel will be completed during the ODFW (2000) or the COE Seattle District (2000) preferred in-water work period ², as appropriate for the project area, unless otherwise approved in writing by NOAA Fisheries.
 - b. Cessation of work. Project operations will cease under high flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage.
2. To implement reasonable and prudent measure #2 (maintenance dredging), the COE shall ensure that:
 - a. Dredge Material Evaluation Framework. Sediment quality will be evaluated before dredging begins using the most recent version of NOAA Fisheries' approved criteria for evaluation of contaminated sediments.³ Only sediments approved for in-water disposal by those criteria will be authorized for maintenance dredging.
 - b. Dredge operation. Dredges will be operated as follows:
 - i. A hydraulic dredge intake must be kept at or just below the surface of the material being removed, but may be raised for brief periods of purging or flushing.
3. To implement reasonable and prudent measure #3 (monitoring), the COE shall ensure that:
 - i. Implementation monitoring. Ensure that each permittee submits a monitoring report to the COE within 120 days of project completion describing the permittee's success meeting his or her permit conditions. Each project level monitoring report will include the following information.
 - ii. Project identification

² Oregon Department of Fish and Wildlife, *Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources*, 12 pp (June 2000) (identifying work periods with the least impact on fish) (http://www.dfw.state.or.us/ODFWhtml/InfoCntrHbt/0600_inwtrguide.pdf); U.S. Army Corps of Engineers, Seattle District, *Approved Work Windows for Fish Protection* (Version: 13 October 2000) (http://www.nws.usace.army.mil/reg/Programmatic_Consultations/TimCond/WorkWinI.pdf)

³ See, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Oregon Department of Environmental Quality, Washington Department of Ecology, and Washington Department of Natural Resources, *Dredged Material Evaluation Framework: Lower Columbia River Management Area* (November 1998) (providing a consistent set of procedures to determine sediment quality for dredging activity) (<http://www.nwp.usace.army.mil/ec/h/hr/Final/>).

- (1) Permittee name, permit number, and project name.
 - (2) Category of activity
 - (3) Project location, including any compensatory mitigation site(s), by 5th field HUC and by latitude and longitude as determined from the appropriate USGS 7-minute quadrangle map
 - (4) COE contact person.
 - (5) Starting and ending dates for work completed
- iii. Narrative assessment. A narrative assessment of the project's effects on natural stream function.
- iv. Photo documentation. Photos of habitat conditions at the project and any compensation site(s), before, during, and after project completion.⁴
 - (1) Include general views and close-ups showing details of the project and project area, including pre and post construction.
 - (2) Label each photo with date, time, project name, photographer's name, and a comment about the subject.
- v. Other data. Additional project-specific data, as appropriate for individual projects.
 - (1) Work cessation. Dates work cessation was required due to high flows.
 - (2) Fish screen. Compliance with NOAA Fisheries' fish screen criteria.
 - (3) A summary of pollution and erosion control inspections, including any erosion control failure, hazardous material spill, and correction effort.
 - (4) Minor discharge and excavation/maintenance dredging.
 - (a) Volume of dredged material.
 - (b) Water depth before dredging and within one week of completion.
 - (5) Site restoration.
 - (a) Finished grade slopes and elevations.
 - (b) Log and rock structure elevations, orientation, and anchoring (if any).
 - (c) Planting composition and density.
 - (d) A five-year plan to:
 - (i) Inspect and, if necessary, replace failed plantings to achieve 100% survival at the end of the first year, and 80% survival or 80% coverage after five years (including both plantings and natural recruitment).
 - (ii) Control invasive non-native vegetation.

⁴ Relevant habitat conditions may include characteristics of channels, eroding and stable streambanks in the project area, riparian vegetation, water quality, flows at base, bankfull and over-bankfull stages, and other visually discernable environmental conditions at the project area, and upstream and downstream of the project.

- (iii) Protect plantings from wildlife damage and other harm.
- vi. Submit monitoring reports to:
 - NOAA Fisheries
 - Oregon Habitat Branch, Habitat Conservation Division
 - Attn: 2002/01315
 - 525 NE Oregon Street, Suite 500
 - Portland, OR 97232-2778
- vii. If a dead, injured, or sick endangered or threatened species specimen is located, initial notification must be made to:
 - NOAA Fisheries Law Enforcement Office
 - Vancouver Field Office
 - 600 Maritime, Suite 130
 - Vancouver, WA 98661
 - 360.418.4246

Care will be taken in handling sick or injured specimens to ensure effective treatment and care or the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered and threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

3. MAGNUSON-STEVENSON ACT

3.1 Background

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2)).
- NOAA Fisheries must provide conservation recommendations for any Federal or state action that would adversely affect EFH (§305(b)(4)(A)).
- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with

NOAA Fisheries EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: “Waters” include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; “substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities; “necessary” means the habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem; “spawning, breeding, feeding, or growth to maturity” covers a species’ full life cycle (50 CFR 600.10). Adverse effect means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

EFH consultation with NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action would adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

3.2 Identification of EFH

Pursuant to the MSA the Pacific Fisheries Management Council (PFMC) has designated EFH for Federally-managed fisheries within the waters of Washington, Oregon, and California. Designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and the upriver extent of saltwater intrusion in river mouths along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km) (PFMC 1998a, 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years) (PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border (PFMC 1999).

Detailed descriptions and identifications of EFH are contained in the fishery management plans for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Pacific salmon (PFMC 1999). Casillas *et al.* (1998) provides additional detail on the groundfish EFH habitat

complexes. Assessment of the potential adverse effects to these species' EFH from the proposed action is based, in part, on these descriptions and on information provided by the COE.

3.3 Proposed Actions

The proposed action and action area are detailed above in sections 1.2 and 1.3 of this Opinion. The action area includes habitats that have been designated as EFH for various life-history stages of Starry flounder (*Platichthys stellatus*) and chinook and coho salmon.

3.4 Effects of Proposed Action

As described in detail in section 1.5 of this Opinion, the proposed action may result in short-term adverse effects to a variety of habitat parameters. These adverse effects are: Decreased water quality (turbidity) and entrainment of individuals.

3.5 Conclusion

NOAA Fisheries concludes that the proposed action will adversely affect the EFH for Starry flounder (*Platichthys stellatus*) and chinook and coho salmon.

3.6 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. While NOAA Fisheries understands that the conservation measures described in the Biological Assessment will be implemented by the COE, it does not believe that these measures are sufficient to address the adverse impacts to EFH described above. However, the terms and conditions outlined in section 2.3 are generally applicable to the designated EFH species in section 3.3, and address these adverse effects. Consequently, NOAA Fisheries recommends that they be adopted as EFH conservation measures.

3.7 Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B)) and 50 CFR 600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

3.8 Supplemental Consultation

The COE must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(k)).

4. LITERATURE CITED

- Armstrong, D.A., B.G. Stevens, and J.C. Hoeman. 1982. Distribution and abundance of Dungeness crab and Crangon shrimp, and dredged-related mortality of invertebrates and fish in Grays Harbor, Washington. Tech. Rpt. School of Fisheries. Univ. of Washington, Washington Department of Fisheries, and Seattle District Corps of Engineers. 349 p.
- Beauvais, S.L., S.B. Jones, S.K. Brewer, and E.E. Little. 2000. Physiological measures of neurotoxicity of diazinon and malathion to larval rainbow trout (*Oncorhynchus mykiss*) and their correlations with behavioral measures. *Environmental Toxicology and Chemistry*, 19(7): 1875-1880.
- Bell, M.C. 1991. Fisheries handbook of Engineering requirements and biological criteria. Fish Passage Development and Evaluation Program. U.S. Army Corps of Engineers. North Pacific Division.
- Berg, L. and T.G. Northcote. 1985. "Changes In Territorial, Gill-Flaring, and Feeding Behavior in Juvenile Coho Salmon (*Oncorhynchus kisutch*) Following Short-Term Pulses of Suspended Sediment." *Canadian Journal of Fisheries and Aquatic Sciences* 42:1410-1417.
- Birtwell, I. K., G. F. Hartman, B. Anderson, D. J. McLeay, and J. G. Malick. 1984. "A Brief Investigation of Arctic Grayling (*Thymallus arcticus*) and Aquatic Invertebrates in the Minto Creek Drainage, Mayo, Yukon Territory: An Area Subjected to Placer Mining." *Canadian Technical Report of Fisheries and Aquatic Sciences* 1287.
- Bjornn, T.C., and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. Pages 83-138 in W.R. Meehan, ed. *Influences of forest and rangeland management on salmonid fishes and their habitats*. American Fisheries Society Special Publication 19:83-138.
- Boyd, F.C. 1975. Fraser River dredging guide. Tech. Rpt. Series No. PAC/T-75-2. Fisheries and Marine Service, Environment Canada.
- Brewer, S.K., E.E. Little, A.J. DeLonay, S.L. Beauvais, S.B. Jones, and M.R. Ellersieck. 2001. Behavioral dysfunction correlate to altered physiology in rainbow trout (*Oncorhynchus mykiss*) exposed to cholinesterase-inhibiting chemicals. *Archives of Environmental Contamination and Toxicology* 40:70-76.
- Burgner, R. L. 1991. Life history of sockeye salmon (*Oncorhynchus nerka*). Pages 1-117 in Groot, C. and L. Margolis (eds.). *Pacific Salmon Live Histories*. University of British Columbia Press, Vancouver, British Columbia, Canada.

- Busby, P., S. Grabowski, R. Iwamoto, C. Mahnken, G. Matthews, M. Schiewe, T. Wainwright, R. Waples, J. Williams, C. Wingert, and R. Reisenbichler. 1995. Review of the status of steelhead (*Oncorhynchus mykiss*) from Washington, Idaho, Oregon, and California under the U.S. Endangered Species Act. 102 p. plus 3 appendices.
- Busby, P.J., T.C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NWFSC-27, 261 p.
- Casillas, E., L. Crockett, Y. deReynier, J. Glock, M. Helvey, B. Meyer, C. Schmitt, M. Yoklavich, A. Bailey, B. Chao, B. Johnson and T. Pepperell. 1998. Essential Fish Habitat West Coast Groundfish Appendix. National Marine Fisheries Service. Seattle, Washington. 778 p.
- DeVore, P. W., L. T. Brooke, and W. A. Swenson. 1980. "The Effects of Red Clay Turbidity and Sedimentation on Aquatic Life In the Nemadji River System. Impact of Nonpoint Pollution Control on Western Lake Superior." S. C. Andrews, R. G. Christensen, and C. D. Wilson. Washington, D.C., U.S. Environmental Protection Agency. EPA Report 905/9-79-002-B.
- Dutta, L.K. and P. Sookachoff. 1975a. Assessing the impact of a 24" suction pipeline dredge on chum salmon fry in the Fraser River. Fish. And Marine Serv., Environment Canada, Tech. Rep. Ser. No. PAC/T-75-26. 24 p.
- Dutta, L.K. and P. Sookachoff. 1975b. A review of suction dredge monitoring in the lower Fraser River, 1971-1975. Fish. And Marine Serv., Environment Canada, Tech. Rep. Ser. No. PAC/T-75-27. 100 p.
- Emmet, R.L., G.T. McCabe, Jr. and W.D. Muir. 1988. Effects of the 1980 Mount St. Helens eruption on Columbia River estuarine fishes: implications for dredging on Northwest estuaries. Pages 74-91 in C. A. Simenstad (ed.). Effects of dredging on anadromous Pacific coast fishes. Washington Sea Grant Program. Washington State University. Seattle, Washington.
- Gregory, R.S. 1988. Effects of Turbidity on benthic foraging and predation risk in juvenile chinook salmon. Pages 64-73 in C. A. Simenstad (ed.). Effects of dredging on anadromous Pacific coast fishes. Washington Sea Grant Program. Washington State University. Seattle, Washington.
- Gregory, R.S. 1993. Effect of turbidity on the predator avoidance behavior of juvenile chinook salmon (*Oncorhynchus tshawytscha*). Canadian J. Fish. Aquatic Sciences 50:241-246.

- Gregory, R.S., and C.D. Levings. 1998. "Turbidity Reduces Predation on Migrating Juvenile Pacific Salmon." *Transactions of the American Fisheries Society* 127: 275-285.
- Healey, M.C. 1991. Life history of chinook salmon (*Oncorhynchus tshawytscha*). Pages 311-393 in Groot, C. and L. Margolis (eds.). 1991. *Pacific salmon life histories*. Vancouver, British Columbia: University of British Columbia Press.
- Hershman, M.J. 1999. Seaport development and coastal management programs: a national overview. *Coastal Management* 27:271-290.
- Kirn, R.A., R.D. Ledgerwood and A.L. Jensen. 1986. Diet of subyearling chinook salmon (*Oncorhynchus tshawytscha*) in the Columbia River estuary and changes effected by the 1980 eruption of Mount St. Helens. *Northwest Science* 60:191-195.
- Johnson, L. 2000. An analysis of support of sediment quality thresholds for polycyclic aromatic hydrocarbons (PAHs) to protect estuarine fish. National Marine Fisheries Service, Seattle, WA. July 24.
- Johnson, O.W., W.S. Grant, R.G. Cope, K. Neely, F.W. Waknitz, and R.S. Waples. 1997. Status review of chum salmon from Washington, Oregon, and California. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-32, 280 p.
- Lloyd, D.S. 1987. Turbidity as a Water Quality Standard for Salmonid Habitats in Alaska. *North American Journal of Fisheries Management* 7:34-45.
- Lloyd, D.S., J.P. Koenings, and J.D. LaPerriere. 1987. "Effects of Turbidity in Fresh Waters of Alaska." *North American Journal of Fisheries Management* 7:18-33.
- Matthews, G.M. and R.S. Waples. 1991. Status review for Snake River spring and summer chinook salmon. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-F/NWC-200, 75 p.
- McLeay, D. J., G. L. Ennis, I. K. Birtwell, and G. F. Hartman. 1984. "Effects On Arctic Grayling (*Thymallus arcticus*) of Prolonged Exposure to Yukon Placer Mining Sediment: A Laboratory Study." Canadian Technical Report of Fisheries and Aquatic Sciences 1241.
- Meador, J.P. 1991. The interaction of dissolved organic carbon, pH, and total copper in the determination of ionic copper toxicity. *Aquatic Toxicology* 19:13-32.
- Moore, A.W. and C.P. Waring. 1996. Sublethal effects of the pesticide Diazinon on olfactory function in mature male Atlantic salmon parr. *Journal of Fish Biology* 48:758-775.

- Moore, A.W. and C.P. Waring. 2001. The effects of a synthetic pyrethroid pesticide on some aspects of reproduction in Atlantic salmon (*Salmo salar* L.). *Aquatic Toxicology* 52:1-12.
- Morton, J.W. 1977. Ecological effects of dredging and dredge spoil disposal: a literature review. U.S. Fish and Wildlife Service Technical Paper No. 94. 33 p.
- Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Liehr, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of chinook salmon from Washington, Idaho, Oregon, and California. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-35, 443 p.
- Neff, J.M. 1985. Polycyclic aromatic hydrocarbons. Pages 416-454 in G.M. Rand and S.R. Petrocelli. *Fundamentals of aquatic toxicology*. Hemisphere Publishing, Washington, D.C.
- Newcombe, C. P., and D. D. MacDonald. 1991. "Effects of Suspended Sediments on Aquatic Ecosystems." *North American Journal of Fisheries Management* 11: 72-82.
- Nightingale, B., and C. Simenstad. 2001. White Paper: Dredging Activities, Marine Issues. University of Washington, Wetland Ecosystem Team, School of Aquatic and Fisheries Science, Seattle, Washington.
- NMFS (National Marine Fisheries Service). 1993. Endangered Species Act - Section 7 Consultation, Biological Opinion: Columbia River Operation and Maintenance Dredging. Issued to the U.S. Army Corps of Engineers, December 22, 1993. Northwest Region, Seattle, Washington. 24 p.
- NMFS (National Marine Fisheries Service). 1998. Position Document for the Use of Treated Wood in Areas within Oregon Occupied by Endangered Species Act Proposed and Listed Anadromous Fish Species. December 1998.
- NMFS (National Marine Fisheries Service). 1999. Endangered Species Act - Section 7 Consultation, Biological Opinion: Columbia River Navigation Channel Operation and Maintenance Program (OSB1999-0112). Issued to the U.S. Army Corps of Engineers, September 15, 1999. Northwest Region, Seattle, Washington. 22 p.
- NMFS. Biological Opinion: Reinitiation of Consultation on Operation of the Federal Columbia River Power System, Including the Juvenile Fish Transportation Program, and 19 Bureau of Reclamation Projects in the Columbia Basin. Web site: <http://www.nwr.noaa.gov/1hydrop/hydroweb/docs/Final/2000Biop.html>. December 21, 2000.

- ODFW (Oregon Department of Fish and Wildlife). 2000. Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources. 12 p.
(http://www.dfw.state.or.us/ODFWhtml/InfoCntrHbt/0600_inwtrguide.pdf).
- PFMC (Pacific Fishery Management Council), 1998a. Final Environmental Assessment/Regulatory Review for Amendment 11 to the Pacific Coast Groundfish Fishery Management Plan. October 1998.
- PFMC (Pacific Fishery Management Council), 1998b. The Coastal Pelagic Species Fishery Management Plan: Amendment 8. Portland, Oregon.
- PFMC (Pacific Fishery Management Council). 1999. Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and Identification of Essential Fish Habitat, Adverse Impacts and Recommended Conservation Measures for Salmon. Portland, Oregon.
- Redding, J. M., C. B. Schreck, and F. H. Everest. 1987. "Physiological Effects on Coho Salmon and Steelhead of Exposure to Suspended Solids." *Transactions of the American Fisheries Society* 116:737-744.
- Salo, E.O. 1991. Life history of chum salmon (*Oncorhynchus keta*). Pages 231-309 in Groot, C. and L. Margolis (eds.). 1991. *Pacific salmon life histories*. Vancouver, British Columbia: University of British Columbia Press.
- Scannell, P.O. 1988. Effects of Elevated Sediment Levels from Placer Mining on Survival and Behavior of Immature Arctic Grayling. Alaska Cooperative Fishery Unit, University of Alaska. Unit Contribution 27.
- Scholz, N.L., N.K. Truelove, B.L. French, B.A. Berejikian, T.P. Quinn, E. Casillas, and T.K. Collier. 2000. Diazinon disrupts antipredator and homing behaviors in chinook salmon (*Oncorhynchus tshawytscha*). *Can. J. Fish. Aquat. Sci.* 57:1911-1918.
- Servizi, J.A. 1988. Sublethal effects of dredged sediments on juvenile salmon. Pages 57-63 in C. A. Simenstad (ed.). *Effects of dredging on anadromous Pacific coast fishes*. Washington Sea Grant Program. Washington State University. Seattle, Washington.
- Servizi, J. A., and Martens, D. W. 1991. "Effects of Temperature, Season, and Fish Size on Acute Lethality of Suspended Sediments to Coho Salmon." *Canadian Journal of Fisheries and Aquatic Sciences* 49:1389-1395.
- Sigler, J.W. 1988. Effects of chronic turbidity on anadromous salmonids: recent studies and assessment techniques perspective. Pages 26-37 in C. A. Simenstad (ed.). *Effects of dredging on anadromous Pacific coast fishes*. Washington Sea Grant Program. Washington State University. Seattle, Washington.

- Sigler, J. W., T. C. Bjornn, and F. H. Everest. 1984. "Effects of Chronic Turbidity on Density and Growth of Steelheads and Coho Salmon." *Transactions of the American Fisheries Society* 113:142-150. 1984.
- Spence, B.C., G.A. Lomnický, R.M. Hughes, and R.P. Novitzki. 1996. *An Ecosystem Approach to Salmonid Conservation*. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, Oregon. 356 p. Available from the National Marine Fisheries Service, Portland, Oregon.
- Tutty, B. D. 1976. Assessment of techniques used to quantify salmon smolt entrainment by a hydraulic suction hopper dredge in the Fraser River estuary. *Fish. And Mar. serv.* Environment Canada. Tech. Rept. Ser. No. PAC/T-76-16.
- Waples, R.S., O.W. Johnson, and R.P. Jones, Jr. 1991a. Status review for Snake River sockeye salmon. U.S. Dept. Commer., NOAA Tech. Memo. NMFS F/NWC-195. 23 p.
- Waples, R.S., R.P. Jones, Jr., B.R. Beckman, and G.A. Swan. 1991b. Status review for Snake River fall chinook salmon. U.S. Dept. Commer., NOAA Tech. Memo. NMFS F/NWC-201. 73 p.
- Waring, C.P. and A. Moore. 1997. Sublethal effects of a carbamate pesticide on pheromonal mediated endocrine function in mature male Atlantic salmon (*Salmo salar* L.) parr. *Fish Physiology and Biochemistry* 17:203-211.
- Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, Washington.
- Whitman, R.P., T.P. Quinn and E.L. Brannon. 1982. Influence of suspended volcanic ash on homing behavior of adult chinook salmon. *Trans. Am. Fish. Soc.* 113:142-150.
- Zuranko, D.T., R.W. Griffiths, and N.K. Kaushik. 1997. Biomagnification of polychlorinated biphenyls through a riverine food web. *Environ. Toxicol. Chem.* 16:1463-1471.

Table 1. References for Additional Background on Listing Status, Biological Information, Protective Regulations, and Critical Habitat Elements for the ESA-Listed Species Considered in this Consultation.

Species ESU	Status	Critical Habitat ⁵	Protective Regulations	Biological Information, Historical Population Trends
Chinook salmon (<i>O. tshawytscha</i>)				
Snake River fall-run	T 4/22/92; 57 FR 14653 ⁶	12/28/93; 58 FR 68543	7/10/00; 65 FR 42422	Waples <i>et al.</i> 1991b; Healey 1991
Snake River spring/summer run	T 4/22/92; 57 FR 14653 ²	10/25/99; 64 FR 57399 ⁷	7/10/00; 65 FR 42422	Matthews and Waples 1991; Healey 1991
Lower Columbia River	T 3/24/99; 64 FR 14308	2/16/00; 65 FR 7764	7/10/00; 65 FR 42422	Myers <i>et al.</i> 1998; Healey 1991
Upper Willamette River	T 3/24/99; 64 FR 14308	2/16/00; 65 FR 7764	7/10/00; 65 FR 42422	Myers <i>et al.</i> 1998; Healey 1991
Upper Columbia River spring-run	E 3/27/99; 64 FR 14308	2/16/00; 65 FR 7764	7/10/00; 65 FR 42422	Myers <i>et al.</i> 1998; Healey 1991
Chum salmon (<i>O. keta</i>)				
Columbia River	T 3/25/99; 64 FR 14508	2/16/00; 65 FR 7764	7/10/00; 65 FR 42422	Johnson <i>et al.</i> 1997; Salo 1991
Sockeye salmon (<i>O. nerka</i>)				
Snake River	E 11/20/91; 56 FR 58619	12/28/93; 58 FR 68543	11/20/91; 56 FR 58619	Waples <i>et al.</i> 1991a; Burgner 1991
Steelhead (<i>O. mykiss</i>)				
Lower Columbia River	T 3/19/98; 63 FR 13347	2/16/00; 65 FR 7764	7/10/00; 65 FR 42422	Busby <i>et al.</i> 1995; 1996
Middle Columbia River	T 3/25/99; 64 FR 14517	2/16/00; 65 FR 7764	7/10/00; 65 FR 42422	Busby <i>et al.</i> 1995; 1996
Upper Columbia River	E 8/18/97; 62 FR 43937	2/16/00; 65 FR 7764	7/10/00; 65 FR 42422	Busby <i>et al.</i> 1995; 1996
Upper Willamette River	T 3/25/99; 64 FR 14517	2/16/00; 65 FR 7764	7/10/00; 65 FR 42422	Busby <i>et al.</i> 1995; 1996
Snake River Basin	T 8/18/97; 62 FR 43937	2/16/00; 65 FR 7764	7/10/00; 65 FR 42422	Busby <i>et al.</i> 1995; 1996

⁵ Critical habitat designations (excluding Snake River stocks) were vacated and remanded on May 7, 2002 by a Federal Court

⁶ Also see 6/3/92; 57 FR 23458, correcting the original listing decision by refining ESU ranges.

⁷ This corrects the original designation of 12/28/93 (58 FR 68543) by excluding areas above Napias Creek Falls, a naturally impassable barrier.

